CLAIMS:

I claim:

1. A method for treating wastewater comprising the steps of:

providing a source of wastewater that comprises animal feces with at least one organic carbon component at least a portion of which is an insoluable solid and a nitrogenous waste;

introducing the wastewater into an inlet of a clarifier, said clarifier having a top edge and a bottom;

clarifying the wastewater to at least partially separate the wastewater into a clear water portion at or near the top edge of the clarifier and wherein the solids are at least partially concentrated into a solids portion at or near the bottom of the clarifier;

removing at least a part of the clear water portion to a lagoon for nitrification and/or denitrification and/or a biological reduction of carbon;

moving at least a part of the solids portion to an anaerobic digester for treatment, said digester containing at least one anaerobic culture, wherein said at least one culture reduces the organic content of the solids portion and produces a biogas comprised of methane and/or carbon dioxide and/or hydrogen sulfide; and

moving at least a portion of the wastewater from the anaerobic digester that has undergone an anaerobic digestion to said lagoon for a further treatment.

2. The method of Claim 1, further comprising the steps of:

collecting the biogas from the anaerobic digester; and

storing the biogas and/or burning the biogas.

3. The method of Claim 1, further comprising the step of covering an anaerobic digester with a floating cover that is nonpermeable or semipermeable.

4. The method of Claim 2, further comprising the step of covering an anaerobic digester with a semipermeable membrane comprised of a ultraviolet resistant polymer material that allows the biogas to slowly diffuse and to become at least partially oxidized and deodorized.

5. The method of Claim 4, further comprising the step of using bacteria on and/or in the membrane to at least partially oxidize and deodorize the diffusing biogas.

6. The method of Claim 2, further comprising the step of burning the biogas for a heat source to elevate the temperature of the wastewater in the anaerobic digester and/or burning the biogas to generate electricity.

7. The method of Claim 6, further comprising the steps of:

using an engine to burn the biogas to drive a generator and produce electricity, wherein the engine produces a heated exhaust and engine waste heat; and

using at least a portion of the engine waste heat and/or heated exhaust to raise the temperature of the water in the anaerobic digester in order to speed up the anaerobic digester.

8. The method of Claim 1, wherein the anaerobic digester reduces the amount of organic components in the wastewater to approximately about 100 mg/l to about 10,000 mg/l and/or wherein the concentration of the solids allows the use of an anaerobic digester of a reduced size as compared to an anaerobic digester that has solids that have not been concentrated.

9. The method of Claim 1, wherein the lagoon reduces the amount of organic components in the wastewater to approximately about 25 mg/l to about 1,000 mg/l and/or wherein nitrogenous wastes are reduced by denitification to about 5 mg/l to about 250 mg/l.

10. The method of Claim 1, further comprising the steps of:

treating at least a first portion of the wastewater in the lagoon with at least one anoxic culture in an anoxic zone;

treating at least a second portion of the wastewater in the lagoon with at least one anaerobic culture in an anaerobic zone;

treating at least a third portion of the wastewater in the lagoon with at least one aerobic culture in an aerobic zone; and

wherein said cultures biologically reduce carbon from said wastewater and/or reduce the nitrogen content of the wastewater.

11. The method of Claim 10, further comprising the step of:

providing at least one means for supplying exogenous oxygen to facilitate nitrification and/or denitrification and/or for biological reduction of carbon, and cause convective flow proximate to said exogenous oxygen into the lagoon.

12. The method of Claim 10, further comprising the step of storing at least a portion of the treated wastewater downstream from the lagoon.

13. The method of Claim 10, further comprising the step of recycling at least a portion of the treated wastewater downstream from the lagoon and/or irrigating with at least a portion of the treated wastewater.

14. The method of Claim 1, further comprising the step of treating the wastewater with at least one chemical upstream from the clarifier.

15. The method of Claim 10, further comprising the step of using at least one of aerator in said lagoon which causes convective flow and aerobic conditions proximate to said aerators when the aerators are turned on, anoxic conditions away from said aerators, and the cycling of at least a portion of said wastewater from aerobic conditions to anoxic conditions and from anoxic conditions to aerobic conditions when said aerators are turned on and off.

16. The method of Claim 15, further comprising the step of controlling at least one aerator by an on-off switch that is manually and/or automatically operated.

17. The method of Claim 15, further comprising the steps of:

turning off the supply of exogenous oxygen when a desired oxygen level is achieved, wherein at least one aerobic zone cycles from aerobic conditions to anoxic conditions and from anoxic conditions to aerobic conditions;

turning on the supply of oxygen when said oxygen level achieves a different pre-set level; and

cycling said turning off and said turning on of said oxygen.

18. The method of Claim 15, further comprising the step of:

determining the level of oxygen in said at least one aerobic culture zone by placing a probe in the aerobic zone and/or by laboratory testing of wastewater from the aerobic zone.

19. A method for treating wastewater comprising the steps of:

providing a source of wastewater that comprises animal feces with at least one organic carbon component at least a portion of which is an insoluable solid and a nitrogenous waste;

introducing the wastewater into a clarifier comprising an inlet, a top edge, and a bottom;

clarifying the wastewater to at least partially separate the wastewater into a clear water portion at or near the top of the clarifier and an at least partially concentrated solids portion at or near the bottom of the clarifier;

removing at least a part of the clear water portion to a lagoon for nitrification and/or denitrification and/or a biological reduction of carbon;

treating at least a portion of the wastewater in the lagoon with at least one anoxic culture in an anoxic zone;

moving at least a part of the solids portion to an anaerobic digester for a treatment, said digester containing at least one anaerobic culture, wherein said at least one culture reduces an organic content of the solids portion and produces a biogas comprised of methane and/or carbon dioxide and/or hydrogen sulfide;

collecting the biogas from the anaerobic digester;

moving at least a portion of the wastewater from the anaerobic digester to a lagoon for a further treatment by said cultures in said zones;

treating at least a first portion of the wastewater in the lagoon with at least one anaerobic culture in a zone wherein dissolved oxygen is absent;

treating at least a second portion of the clear water wastewater and/or the wastewater from the anaerobic digester in the lagoon with at least one aerobic culture in an aerobic zone in the presence of dissolved oxygen;

treating at least a third portion of the wastewater in the lagoon with at least one anoxic culture in an anoxic zone;wherein the treatment by said cultures further biologically reduces carbon material from said wastewater and/or reduces the nitrogen content of the wastewater;

storing the treated water from the lagoon for use and/or using the treated water from the lagoon; and

burning the biogas to raise the temperature of the wastewater in the anaerobic digester and/or burning the biogas the generate electricity.

20. The method of Claim 19, further comprising the steps of:

providing a wastewater outlet line from the anaerobic digester;

connecting the wastewater outlet line to a heat exchanger which utilizes a heat from an engine that is burning biogas and producing a heated exhaust and an engine waste heat;

circulating the wastewater through the heat exchanger and feeding an engine coolant into said heat exchanger to cool the engine and to heat the wastewater circulating through the engine;

returning the heated wastewater to the anaerobic digester; and

raising the temperature of the wastewater in the anaerobic digester.

21. The method of Claim 19, further comprising the steps of:

providing a wastewater outlet line from the anaerobic digester that at least partially fills a heating tank;

placing a heat conductive coil in the heating tank;

connecting a conduit to an exhaust pipe and/or an engine cooling system of an engine that is burning the biogas and is producing a heated exhaust and an engine waste heat;

connecting said conduit from the engine to the coil, so that the heated exhaust and/or engine waste heat flows through the coil and heats the wastewater in the heating tank and cools the engine;

returning at least a portion of the heated wastewater to the anaerobic digester; and

raising the temperature of the wastewater in the anaerobic digester.

22. The method of Claim 19, further comprising the steps of:

providing a wastewater outlet line from the anaerobic digester that at least partially fills a heating tank;

placing a heat conductive coil in the heating tank;

connecting a conduit to an exhaust pipe and/or an engine cooling system of a generator that is burning the biogas and is producing a heated exhaust and a waste heat;

connecting said conduit from the generator to the coil, so that the heated exhaust and/or waste heat flows through the coil and heats the wastewater in the heating tank and cools the generator;

returning at least a portion of the heated wastewater to the anaerobic digester; and

raising the temperature of the wastewater in the anaerobic digester.

23. The method of Claim 19, further comprising the step of:

providing at least one means for supplying exogenous oxygen to facilitate nitrification and/or denitrification and/or biologic reduction of carbon, and to cause convective flow proximate to said exogenous oxygen into the lagoon.

24. The method of Claim 19, further comprising the steps of:

obtaining the wastewater comprising animal feces and nitrogenous wastes by flushing the floor of a livestock production facility with treated water from the lagoon..

25. The method of Claim 19, further comprising the step of:

using the treated water downstream from the lagoon for crop irrigation.

26. The method of Claim 19, using at least one means to burn the biogas selected from the group consisting of an engine; a gas generator; an electrical generator; a flare; a gas burner; and a combination thereof.

27. The method of Claim 19, further comprising the step of:

purifying the biogas by using an air separation unit or separating gas comprising methane from the biogas by using a semi-permeable membrane.

28. An apparatus for the treatment of wastewater comprising:

a clarifier comprising an inlet, a top edge, and a bottom, a first outlet at or near the top, and a second outlet at or near the bottom of the clarifier capable of capable of a least partially separating wastewater comprising an organic carbon component and/or a nitrogenous waste into a clear water portion and a concentrate solids portion comprising organic material from the wastewater;

an anaerobic digester downstream from the clarifier that contains at least one anaerobic culture for reducing the organic content of the solids portion, said culture also producing a biogas;

a means for collecting at least a portion of a biogas produced in the anaerobic digester and/or a means to burn at least a portion of the produced biogas;

a lagoon downstream from the anaerobic digester for treating the wastewater from the anaerobic digester and the wastewater from at least the clearwater portion of the wastewater, said lagoon comprising at least one anoxic zone, at least one aerobic zone, and at least one anaerobic zone;

at least one anoxic culture in the anoxic zone, at least one anaerobic culture in anaerobic zone and at least one aerobic culture in an aerobic zone in said cultures biologically reducing carbon from said wastewater and/or nitrifying and/or denitrifying the nitrogenous wastes in said wastewater; and

a means for storing the treated wastewater downstream of the lagoon.

29. The apparatus of Claim 28, further comprising a means for storing said collected biogas.

30. The apparatus of Claim 28, wherein the means for burning said biogas is selected from the group consisting of an engine; a gas generator; an electrical generator; a flare; a gas burner; and a combination thereof.

31. The apparatus of Claim 28, further comprising at least one means for supplying exogenous oxygen to the wastewater in the lagoon to facilitate nitrification and/or denitrification and/or biologic reduction of carbon, and to cause a convective flow proximate to said exogenous oxygen.

32. The apparatus of Claim 31, wherein the means for supplying exogenous oxygen is selected from the group consisting of at least one submerged aerator; at least one surface aerator; a fine bubble aerator; a coarse bubble aerator; a submerged tube with a plurality of air holes therein; a submerged pipe with a plurality of air holes therein; and a combination thereof.

33. The apparatus of Claim 31, wherein said at least one means for supplying oxygen is controlled by an on-off switch that is manually and/or automatically operated.

34. The apparatus of Claim 28, further comprising a outlet wastewater line from anaerobic digester that is connected to a heat exchanger that is used to cool an engine burning biogas and producing a heated exhaust and an engine waste heat, wherein the water from the anaerobic digester is pumped into a heat exchanger and a cooling water from the engine is passed through the heat exchanger, liberating said heat from the engine to the wastewater and returning to cool the engine, and wherein a return line conveys the heated wastewater to the anaerobic digester to raise the temperature of the water in the anaerobic digester.

35. The apparatus of Claim 30, wherein the biogas is burned and used as a heat source to

elevate the temperature of the wastewater in the anaerobic digester and/or wherein the biogas is burned to generate electricity

36. The apparatus of Claim 30, further comprising an on-off switch that manually and/or automatically controls said at least one aerator.

37. The apparatus of Claim 30, wherein said exogenous oxygen is comprised of atmospheric air.

38. The apparatus of Claim 31, further comprising:

a means for turning off the exogenous oxygen when said oxygen level achieves a pre-set level for a pre-set period of time;

a means for turning on the exogenous oxygen when said oxygen level achieves a different pre-set level, wherein said wastewater in said at least one aerobic culture cycles from aerobic conditions to anoxic conditions and from anoxic conditions to aerobic conditions; and

a means for cycling the turning on and off and turning on of said oxygen.

39. The apparatus of claim 37, further comprising a means for determining the level of oxygen in said at least one aerobic culture, wherein said means comprises a probe in said culture and/or laboratory testing of a portion of said aerobic culture.

40. The apparatus of Claim 28, further comprising means to add chemicals upstream of the clarifier and/or adjust the pH of the wastewater downstream from the clarifier.

41. The apparatus of Claim 29, further comprising a compressor for compressing the biogas prior to storing the gas in a storage tank.

42. The apparatus of Claim 29, further comprising

an air separation unit for purifying the methane in the biogas and/or a semi-permeable membrane for at least partially separating methane from the biogas.

43. The apparatus of Claim 29, wherein the concentration of the solids allows the use of an anaerobic digester of a reduced size as compared to an anaerobic digester that has solids that have not been concentrated.